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ELECTRIC POWER AND POWER EQUIPMENT

MERITS OF CHARVAKSKAYA GES ENUMERATED

Moscow PRAVDA in Russian 1 Sep 79 p 3

[Article by Academician A. Sadykov, president of the Uzbek SSR Academy of Sciences and V. Skrebnev, chairman of the Uzbek SSR Gosstroy: "In the Mountain Spurs of Tien Shan"]

[Text] The Charvakskaya GES, conceived and built as a unique hydrotechnical installation, is playing a great role in the solution of a number of our entire republic's important economic problems. The commissioning of this highly efficient hydrotechnical installation opens the means for improving the supply of water to 460,000 hectares of irrigated land and for bringing 150,000 hectares of new land under irrigation. The seasonal regulation of the river Chirchik's flow and the creation of a two-billion cubic meter reservoir as part of a hydraulic development for improving irrigation conditions has provided, particularly during the previous run of low-water years, a surplus of more than 230,000 tons of cotton wool during those years and has increased the productivity of other crops in Tashkentskaya Oblast.

At its regulated output of 600,000 kilowatts, the GES in one year generates two billion kilowatt-hours of electric power, the cost of which is five to six times less than the cost such large-scale thermal electric stations as the Tashkent and Syrdar'in stations, which operate on fuel oil.

Operational practice has proven the high efficiency of the Charvakskaya complex. By 1978 all capital investments in the construction of the GES had been completely recouped.

The Charvakskaya GES reflects the latest achievements of the scientific-technical thought of Soviet hydroelectric power specialists. This hydraulic development in the Tien Shan mountain spurs is one of the examples of construction art.

The hydraulic development's dam, 168 meters high with a crest approximately a kilometer long, is in an area of geologically complex mountain formations having force-eight seismic activity. In world-wide hydroenergetics it is the first dam to be built using local materials. The departure from classical concrete construction has made possible the total elimination of expenditures for an entire complex of concrete plants and sifting machines, and has permitted the acquisition of the corresponding equipment. The dam turned out to be 35 to 40 percent less expensive and its construction time was cut by three years. A complex of design, scientific and experimental operations (including those done on a specially constructed test range) has made possible the selection of the optimal methods of preparation and tamping of loamy soil and rocky material, ensuring the dam's solidity and water-tightness.

The effectiveness of capital investments rose significantly thanks to the early engagement of the GES's units at reduced pressures while the dam was still under construction. The GES output was subsequently stepped up to its designed power.

The hydraulic development's structures were outfitted with a great many pieces of specially designed equipment, the creation of which is of great scientific and technical value.

The results of complex experiments carried out in the summer of 1978 when the reservoir was filled and all of the GES's structures and equipment were brought up to design pressures, regulations and parameters have once again affirmed the high quality of construction and installation work and the reliability of the scientific-technical decisions adopted.

High efficiency and complexity, reliability and durability, and the modern level of technical progress and aesthetics--that's what characterizes this hydraulic development.

In November of 1977 Comrade L.I. Brezhnev, general secretary of the CPSU Central Committee and chairman of the Presidium of the USSR Supreme Soviet, warmly congratulated all the participants in the development's construction, noting their selfless labor. The creation and assimilation of the Charvakskiy hydraulic development has on its merits been nominated to competition for the USSR State Prize.

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ELECTRIC POWER AND POWER EQUIPMENT

ALTERNATE ENERGY SOURCES REVIEWED

Baku VYSHKA in Russian 12 Sep 79 p 2

[Article by M. Bakirov, manager of the radiation research sector of the Azerbaijan SSR Academy of Sciences and doctor of physical and mathematical sciences: "The Treasures of Radiant Energy"]

[Text] The goal that's been set before our specialists is the extraction and utilization of so-called natural energy in the economy. The situation taking shape in world energetics affirms the importance of the course that has been taken. I'm sure that solar and wind energy have a great future. What's been said here pertains especially to our republic, where the highest possible number of sunny and windy days are recorded in the course of the year. One of the advantages of these types of energy is that they don't pollute the environment. You will agree that this is a factor of no little importance. Thus, experiments in our sector have already been conducted on several makes of automobiles that run on a new hydrogen fuel, obtained through the use of energy from the sun and wind. Hydrogen gives away nothing to gasoline, and instead of the harmful exhaust gases, ordinary water is released. True, the cost of the new fuel is high for the time being, but it will, without a doubt, fall in the future. In a word, the prospects are enticing. Today in our sector, wind-powered electric and photoelectric hydrogen installations have already been developed which allow the extraction of hydrogen by the electrolysis of water. We've also constructed a solar electrotechnical installation for implementing a thermochemical process of obtaining acetylene; its main subassemblies have been manufactured and installed.

We've completed the installation of an applied solar energy plant for obtaining a fuel mixture through the thermochemical decomposition of water. The plant's principle of operation is also based on the use of solar rays. Under the influence of heat from the latter, ordinary water, at the moment it passes

through a special transformer, is broken down and converted into a fuel mixture.

We scientists have been highly excited about a recent resolution of the CPSU Central Committee and the USSR Council of Ministers "On the Improvement of Planning and the Strengthening of the Economic Machinery's Influence on the Rise in Production Efficiency and the Quality of Work". In it, once again, the role of the achievements of science and technology in increasing the efficiency of the entire economic system is emphasized, and attention is devoted to the accelerated realization of scientific-technical discoveries and developments that are directed at increasing the rate of growth of efficient public labor and the quality of production. The successful realization of these tasks to no small degree depends also upon the efficiency of our labor.

On the other hand, the resolution makes it incumbent upon the ministries, departments and businesses to render more active assistance to science. You know how it goes sometimes. You confer with the production workers, you convince them of the advantages of this same solar energy installation or, let's say, of hydrogen fuel. You get the feeling that the person you're talking to interprets what you've said as fantasy: he becomes wary, plays it safe, indicates some higher authority. He'll say that permission will have to come from above. The new resolution of the CPSU Central Committee and the USSR Council of Ministers aims to make the executives arm themselves more boldly with the achievements of scientific-technical progress, and to see the prospects for developing our sector and direct their efforts toward attaining the ultimate results.

At this present stage, not only the individual scientist but even a scientific colllective is unable to effectively solve more or less large-scale scientific problems acting alone. Our sector of radiation research maintains close ties with many scientific institutions within the republic and in the country. Thus, under the Academy of Sciences' system our sector coordinates the work in problems of semiconductor physics and hydrogen energetics with institutes of physics, chemical processes and space research into natural resources.

Together with the Institute of Chemical Physics of the USSR Academy of Sciences we are conducting research into the radiation decomposition of water with the aim of obtaining hydrogen. The laboratory of ferroelectric materials maintains communications with a number of scientific research establishments in foreign countries concerning the study of problems of the structure of dielectric and electric properties of ferroelectric materials and their practical utilization.

The lively collaboration with the collectives is always fruitful. Take, for example, the work on achieving new properties for semiconductors and the creation, on the basis of these properties, of solar energy converters. This work was carried out in conjunction with the I.V. Kurchatov Institute of Atomic Energy. Our specialists maintained the closest of ties with the celebrated scientific collective, visited the institute many times and there became acquainted with advanced methods of conducting research. Naturally, upon their return, their valuable lessons were widely applied within the precincts of our sector. This is to say nothing of such productive forms of the exchange of scientific knowledge as extended apprenticeships and graduate study.

Similar contacts contribute to a more efficient conduction of scientific research, a creative exchange of experience, a rise in the professional level of the scientific cadres and a rise in their knowledgeability.

In perspective, further attention in the radiation research sector will be devoted to the pressing problems of extracting, accumulating, storing and utilizing hydrogen as a fuel element and the conversion of solar and wind energy. Of course, in order to solve this complex of scientific-technical tasks, the corresponding material resources are indispensible. Even today we are installing powerful wind-power and solar-power plants for extracting, accumulating and storing hydrogen, and also the apparatus for processing crop seeds by means of solar rays and magnetic and electrical fields. For carrying out this complex of research in the area of radiation physics we have at our disposal one of the most massive electron accelerators in the country.

ELECTRIC POWER AND POWER EQUIPMENT

PROGRESS ON NIZHNEKAMSKAYA GES

Moscow KRASNAYA ZVEZDA in Russian 20 Aug 79 p 2

[Article by A. Kirillov, doctor of technical sciences: "The Fourth in Cascade"]

[Text] It was recently reported in our paper that the first of the Nizhnekamskaya GES's generating units had been brought into service. Adopting progressive methods of construction, hydroelectric technicians installed it in four months.

Why has this fact attracted attention? First of all, it is because the construction of the Nizhnekamskaya GES completes the creation of a hydroelectric complex on the Kama. The first node in the cascade is located near Perm', the second rises close to the city of Chaykovskiy, and the third is alongside the city of Votkinsk. Alongside the new center of automobile construction in the city of Naberezhnyye Chelny the fourth step of the cascade, the Nizhnekamskaya GES, has begun supplying current. One more step has been taken toward completing the tasks of the 10th Five-Year Plan, the programs of which envisioned bringing the production of electrical power up to 1.34 to 1.38 billion kilowatt-hours in 1980.

An army of two million Soviet electrical workers steadfastly resolves the tasks set before the Party and the government. In December of last year, for example, the unique hydroaggregate at the Sayano-Shushenskaya GES, which has a power output of 640,000 kilowatt-hours, was the first to provide industrial current ahead of schedule. Also put into service were the large-scale hydroelectric aggregates at the Nurekskaya, Ingurskaya and Sayanskaya GESes. The production of electrical energy in our country in the last year reached 1.20 billion kilowatt-hours, which, in comparison with 1975, constitutes a 15.7 percent increase. In the first half of the present year 621 billion kilowatt-hours of electrical energy have been produced.

The technical level of electrical power engineering has also been raised and the economic indicators of the economic activity of energy systems and electrical power stations have been improved. Thus, the unit expenditure of fuel per kilowatt-hour has decreased by more than eight grams, which will ensure a savings of 15 million tons of conventional fuel within the limits of our sector. The efficiency of fuel utilization achieved is in keeping with the goals of the Five-Year Plan.

The Nizhnekamskaya GES will also make its contribution in the struggle for economy and for improving the production of electrical energy. The combined output of its 16 power units will total 1.25 million kilowatts. The GES will produce 2.7 billion kilowatt-hours of electrical energy per year, which will permit a yearly savings of 1.2 million tons of conventional fuel and will free the 5,200 persons whose labor would be required to produce the same amount of electrical energy at a thermal station.

In 1979 power engineers and power station builders have been assigned strenuous goals concerning the rates of growth of efficient labor, decreases in the unit costs for the production of electrical energy, industrial goods, construction and installation works and other planning indicators. Along with the machine builders, they are also confronted with achieving an improvement in the technical-economic characteristics of the equipment. However, there is a good example of such work in the field already. This was the reconstruction not long ago of the hydrogenerators at the Bratskaya GES, as a result of which the output of the electric station increased by 400,000 kilowatts.

In the course of building projects and operating and maintaining equipment, any possible reduction in that portion of work accomplished by low-productive manual labor is also of great significance. Incidentally, this requirement was considered in a practical manner during the construction of the Nizhnekamskaya GES. In its units new technical solutions were employed which significantly accelerated the speed of construction, allowed a reduction of labor expenditures and permitted an increase in the work quality.

For example, during the installation of the GES building, such designs were used for the floodgate slots as would make possible the achievement of higher precision and exclude the labor-consuming concrete-mold work which was unavoidable with the previous method. Exhaust tubes of complex geometric form are cast in concrete, using standard prefabricated elements, which sharply reduce labor consumption and the time needed for this work. The installation of the equipment make wide use of reinforced elements, etc.

The acceleration of scientific-technical progress in electric power production and an increase in the qualitative indicators of economic activity are inseparably linked with the further improvement of the work of scientific-research and design organizations. In our sector special significance is attached to the strengthening of close ties between these organizations and production, and the concentration of attention on the main trends in technical progress. Today the collectives of the electric power stations, businesses, construction, installation and maintenance organizations, and the scientific-research and design institutes of the USSR Minergo direct their efforts to the solution of these and other tasks.

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WORK ON ROVENSKAYA AES PROCEEDS SMOOTHLY

Kiev RABOCHAYA GAZETA in Russian 28 Aug 79 p 1

[Article by RABOCHAYA GAZETA correspondent I. Pashchuk: "The Closer to the Finish..."]

[Text] In the office of V.B. Sukhonosenko, party committee secretary for a key republic Komsomol construction project, is a network schedule of the construction and installation work at the Rovenskaya AES.

"In one year," he ran the pointer along a rising line, "the face of the construction platform has changed so much as to be unrecognizable: new parts of the building complex have sprung up which now are already fitted out with equipment. The construction and installation plan, according to the chief general contractor, is committed to completion by Power Specialists' Day. In addition, we will bring it in at 400,000 rubles under budget."

At the construction site they speak highly of "Yuzhteploenergomontazh", a harmonious collective in the installation sector. It completed 130 percent of the plan for the second quarter, and 108 percent of the plan for the first half of the year. The thermal equipment fitters installed more than one hundred pieces of equipment, erected regeneration systems and a deaerator for the first turbine, laid 640 tons of piping, completely enclosed the high and low-pressure cylinders, and installed the generator stator. Now they are successfully carrying out work on the number-two turbine: ahead of schedule they are installing the technical equipment, the pipelines and the junctions on the main circular contour in the reactor compartment.

"It's easy to work with such people," says E.T. Shevchenko, chief engineer at the Kharkov turbine plant, who is supervising the installation of the turbines. "We'll manage it within the specified time."

Such an attitude is commendable. However, even the related enterprises and suppliers must maintain the rapid pace. You know that delays in providing equipment still occur, and that it happens at building sites still under construction, which slows down the installation. The Pecherskoe administration, for example, held up the delivery of oil-pipeline flanges, equipment needed for oil coolers.

In order to install the turbine pipelines it's necessary to put together multileveled horizontal and vertical systems of scaffolding, but not out of just anything. The construction administration of an atomic power plant can't get by without supplies of wood materials, and the lack of wood has already begun to slow up the installation crews.

Water cooling tower number one is being built along the draft fan pipe. This unit is not ordinary in purpose or in dimensions. The water cooling tower rises 150 meters overhead--almost twice as high as those in operation today. The unit will cool 100,000 cubic meters of water per hour, water necessary for the operation of the first power unit.

"We're sticking to the set pace," says Z.G. Gamrikeli, chief engineer for construction management. "Every two days we raise the collar one and a half meters, and we've gone up a total of 104 meters."

The work of the "Energovysotspetsstroy" high-steel men is responsible. They work essentially on wooden boards alone, along both sides of which is empty space. The thickness of the cooling tower is only 210 mm, which means that it's necessary to fasten the metal casing with absolute precision so that sagging doesn't occur. Examples of this selfless labor are provided by fitters V. Leventsev and O. Sukhonov, crane operators L. Ryabov and A. Pagoda and cement truck drivers O. Zhuvak, S. Leus and others.

The fitters busy in the reactor compartment do not lag behind their neighbors. The work is organized into three shifts. The pace is brisk.

"We're installing the internal structural frames for the covering," says N.T. Tkachenko, team leader for the "Yuzhenergomontazh" section. "They deliver materials in accordance with the orders without delays. There's almost no loss of work time."

But things aren't like this at all the construction sites. The pace has slackened on the construction of the unified auxiliary framework.

"We're 50 or 60 workers short of the number we'd need to stay on schedule," said V.G. Paseka, head of construction management sector number three. "Deliveries of necessary equipment, such as oxygen cylinders, is frequently hampered..."

Those in arrears to the atomic power plant builders are: the Svetlovodskiy, Dneprodzerzhinskiy and Pridneprovskiy reinforced concrete products plants, the Kiev plant for experimental construction, the Kukharovskiy boiler equipment plant and the Bagleyskiy auxiliary boiler equipment and pipeline plant. For the first half of the year they are in arrears 1,929 cubic meters of reinforced concrete and 1,786 tons of metal structural material.

In spite of the temporary difficulties, the builders are working at full output. This guarantees that by the end of the year the plant will put out its first kilowatt-hours of electric power.

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ELECTRIC POWER AND POWER EQUIPMENT

ELECTRICAL EQUIPMENT MINISTER ON NEXT FIVE-YEAR PLAN

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 Aug 79 p 2

[Article by A. Antonov, minister of the USSR Electrical Equipment Industry: "New Technology - The Way to Economy"]

[Text] For a number of years now a distinctly elaborated system of economizing material resources has been in effect in the electrotechnical industry. It has absorbed several trends. These are: the mastery and dissemination of new forms of production with reduced material consumption, the introduction of progressive technological processes, the perfection of methods of establishing norms and the storage and stock-taking of everything which must go into production. The final goal is that all growth in the volume of production output is ensured without drawing substantially upon basic materials - rolled metal, to begin with.

Just what is the result? This is what the analysis shows: in the 9th Five-Year Plan specific quotas for the expenditure of rolled ferrous metals in the sector were reduced by 21.8 percent; in the current Plan, they will decrease by another 16.2 percent, but even with this, for each single percent in growth of the consumption of rolled metal there will be an increase in production 1.3 times greater than that in the 9th Five-Year Plan. From 1975 to 1979 the output volume of electrotechnical products has grown by more than a quarter, while the consumption of rolled ferrous metals has grown only by nine percent, copper by three percent and lead by five. As early as the beginning of the 10th Five-Year Plan workers in the sector saved 252,000 tons of steel and 20,000 tons of copper, lead, etc. A great deal of other materials, fuel and electrical energy was saved.

In the next, the 11th Five-Year Plan, conserved metal will acquire even greater significance in the fulfilment of State plans. In comparison with the 10th Five-Year Plan, our sector will almost have to double the production output for each percent increase in the consumption of rolled ferrous metals in

the years 1981-1985. Their unit cost is planned to decrease another 26.5 percent. This is one of our basic, knotty problems, toward the solution of which efforts are being directed all along the line of "science-technology-production".

The major portion of the savings can be achieved thanks to the creation and mastery of new products that demand less material. For this a system of measures has been worked out: there has been introduced, for example, an economic stimulation of scientific research and experimental design work, organized according to its real effectiveness; the procedure for conducting the examination of material consumption indicators has been regulated in all technical jobs, without exception; a system of dynamic cost analysis is being introduced which allows the most economical design and technological solutions, etc., to be brought to light.

Let us consider another thing: in many cases a reduction in the weight of power machinery doesn't result in an ultimate economic effect. Everything has a scientifically founded limit. When we've reached it, we cause an unavoidable reduction in its characteristics, the coefficient of useful power and other parameters of the product. On the other hand, for example, such products as switching equipment for high-voltage electrical power lines, which are material-consumptive for industry, present the consumer with great savings in material and maintenance expenditures. Consequently, scientific, planning and design organizations are enterprises which, in their activities, are obligated to orient themselves toward the ultimate economic result, which goes beyond the limits of the sector. This is why under the heading of "economy" we include the increased reliability and durability of the product, as well as the creation of specialized designs adapted to specific conditions of operation. Asynchronous motors in special agricultural equipment will serve as an example, for they endure extremely severe conditions of operation under the high moisture and dustiness of the environment.

One of our important trends is the incorporation (in designs and technology) of essentially new solutions. To such work can be attributed the research that's connected with the use of electronic methods in self-contained electrotechnical installations, the creation of equipment for plasma and electron beam technology, etc. Significant results can be expected from measures taken to introduce low-waste technology into production.

Particularly efficient have been standardized articles of mass production. For example, the creation of a standardized series of asynchronous motors has made it possible not only to significantly raise their technical level but also to improve the product list: the number of rarely-used modifications has been

sharply curtailed and universal designs with increased range of application have been mastered. As a result, the introduction of a technically advanced series has brought a significant savings of metal and other materials: at practically the same level of rolled metal consumption the output of motors in the past 4-5 years has been increased 1.4 times.

Such work is now being conducted today on all types of massive electrical equipment.

The savings of material (to a significant degree) depends upon our customers. Thus, questions about the correct use of electrical equipment also come to the fore. Violations of established norms and the incorrect selection of products for some conditions or others unavoidably leads to the premature wear of the equipment, incomplete utilization of its problemsolving capacity and, consequently, to the appearance of artificially overestimated demand.

Toward the goal of a more stringent system of material savings our Ministry considers it expedient to establish a procedure in which the consumer of electrical equipment must coordinate the selection with the developers or other competent representatives and organizations of the electrotechnical industry. The time has come also for a review of a number of GOSTs (State standards) on requirements for the operation of electrical equipment. The guarantee of concord between State interests in the area of material savings and the interests of each of the consumers of our products is being borne in mind. Such concord can only be achieved on the basis of a painstaking analysis of the conditions under which our equipment will be used. This work is already being conducted, and its scope will be broadened. What we're talking about here, in the final analysis, is the creation of an integral and flexible system of direct two-way communication between producers and consumers of electrotechnical equipment.

Today, approaching the end of the 10th Five-Year Plan, we are even now drafting plans for the next period. In addition, we are devoting great attention to the formation of a work program linked with the careful use of materials. Because of it we are being guided by the index of economy as if it was one of the basic indicators that determine the efficiency of our sector of industry. The leading organizations have already expressed their considerations, and they are now being brought together into a composite from which the tasks for all subunits in the years 1981-85 will be determined.

In order to accelerate the introduction of new products which guarantee a significant reduction in the expenditure of material in our sector itself and for the consumer, economic methods will be employed which have been defined in the resolution of the CPSU Central Committee and the USSR Council of Ministers "On the Improvement of Planning and the Strengthening of the Economic Machinery's Influence on the Rise of Production Efficiency and the Quality of Work". However, in our opinion, the maximal effect (meaning the savings of material) can be ensured only when the methods of computing the evaluating indicators which characterize the savings of materials achieved in the sector are clarified and revised in a corresponding manner. The working instructions of the Central Statistical Directorate do not take into account those savings from the introduction of new technology with reduced unit material consumption, increased period of service, improved working conditions, etc.

The ministry has many times addressed the USSR Central Statistical Administration and the USSR Gosplan with proposals to improve them, however, the question is yet to be decided, and an important part of a practicably attainable effect (thanks to the introduction of new technology) remains "beyond the bounds of accountability".

Approximately one-half of the total volume of savings is supposed to be attained thanks to the application of new materials, the substitution of those raw materials in short supply, and also because of the transition to progressive technological processes. Here it must be said that the problem of delivering such materials for the electrotechnical industry has yet to be decided. It is for these materials that we have an acute requirement. Until now the sectors were alloted limited funds for substitutes and cast plastic, the application of which would allow for a sharp reduction in the expenditure of rolled ferrous metals. We also receive an insufficient volume of electrotechnical-grade steel of high quality. Why, the lack of proper materials holds up even the introduction of progressive technological processes. Because the ferrous and nonferrous enterprises do not deliver high-precision perforated shaped stock or powdered iron or copper, we are unable to save tens of thousands of tons of rolled ferrous and nonferrous metals. Rolled metal of dimensions which differ greatly from those which were ordered still find their way into the sector's enterprises. This leads to great losses. In 1978 these losses made up about 15,000 tons. This is only that portion of the loss that can be expressed in numbers with sufficient certainty.

Isn't it true that we have the accumulated experience of an efficient collaboration of specialists in various sectors? This

is, however, only one example. A new class of electrotechnical-grade steel and the new technology to produce cold-rolled unalloyed isotropic steel with high magnetic properties have been developed by engineers of the ferrous metallurgy and electrotechnical industry. Its application instead of that of hot-rolled sheet steel in the manufacture of mass-produced goods in only three years of the Five-Year Plan permitted a savings of about 70 tons of rolled steel. At the same time, heavy manual labor was eliminated. In accordance with the provisions of the recent resolution of the CPSU Central Committee and the USSR Council of Ministers our ministry will actively participate in collaboration with sector affiliates in complex programs for the creation of essentially new materials and replacement products for the electrotechnical industry. The system of combined intersector overall programs has already proven its effectiveness. Aimed at saving materials, it will undoubtedly produce even weightier results.

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ANTONOV ON ELECTRIC EQUIPMENT INDUSTRY

Moscow IZVESTIYA in Russian 20 Sep 79 p 2

[Article by A. Antonov, minister of the USSR electric equipment industry: "The 'Small-Scale' Electric Equipment Industry"]

[Text] I wish to begin with a fact that relates to the history of our energy production: along with the GOELRO plan, the delegates to the 8th All-Russia Congress of Soviets were handed a list on which were schematically arranged the major directions for electrification. One of the arrows pointed to living quarters.

The creation and assimilation of home appliances is an integral part of the party's multifaceted social program, directed at improving the individual's way of life and standard of living. A substantial contribution to the solution to this task is provided by the electrical equipment industry. Our appliances, which have solidly entered people's day-to-day lives--washing machines, vaccuum cleaners, fans, irons, lamps and many other items--have been called upon to make housework easier and to raise the level of comfort in the home. Today the selection of items from the so-called small-scale electrical equipment industry exceeds 1500 items. Approximately one-third of the national output of domestic equipment goes to enterprises within the sector.

Recently, the electrical equipment industry has mastered the production of and introduced into the market such modern products necessary for the home as automatic washing machines, home air conditioners, portable vaccuum cleaners, various items for personal hygiene and self-service appliances. These are products of very complex technology. Their creation and assimilation requires the same arsenal of resources that large-scale electrotechnology demands. Qualified cadres of researchers and developers are needed, and it is necessary to fit enterprises with

the latest technological equipment and to introduce modern methods of organizing production. It is precisely for this creation of technology for the home that leading scientific research and experimental design organizations in the sector and 300 enterprises have been enlisted.

Much more remains to be done in order to make the outward appearance, ease of operation and durable consumer qualities of electric appliances answer the demands of the Soviet people.

In the branch much attention is being devoted to perfecting an over-all system of quality control. All products of home technology are subject to certification. The dissemination of the system of certification and quality control for home appliances has served as a stimulus for raising their level of technology: only three years ago the mark of quality was registered on 26 percent of the total production output of such items and today this indicator has reached 42 percent, which corresponds to the level set for the end of the five-year plan.

In no way detracting from the significance of certification as an important stimulus in raising the quality of our products, it is necessary to note along with this that it only fixes their technological level achieved at some particular stage. As we are frequently convinced, however, a well-conceived design cannot be realized for quite a number of reasons: either we don't have some necessary materials, or the corresponding technology has not been mastered, or production has not been prepared, etc. Moreover, the quality of the article can be lost if it is not used under the conditions for which it was designed. We have put before ourselves this task: to create such a system of measures as will ensure the high quality of the product put in by the planner or the designer, both in the production process and at all stages of the product's "life", right up to the time it becomes obsolete.

A special role in the development of such a system belongs to over-all standardization, which will determine the mutually linked demands of design, production technology, materials, methods of selling ready-made goods, forms of technical service: in other words, overall standardization will establish the task not only for developers of equipment for the home but also for the producers, suppliers of raw materials, and also for trade organizations and consumers. Over-all standards in the sector developed for products of lighting engineering, light sources, electric heating elements, fruit juice makers and other forms of home technology as a matter of fact are long-term programs for developing the production of these groups of wares. At the same time, the quality standards of the products themselves, as well

as that of the wiring, parts and materials used in them will be ensured.

Along with the increase in the prosperity of the Soviet people, the demand grows for electrical engineering products in the home. If we say, for example, that ten years ago the annual unit production of incandescent lamps and galvanic cells numbered in the millions, then today the yearly demand for them exceeds one billion units, which, naturally, requires a powerful, highly industrialized production base. It is precisely for this reason that the technical refitting of the shops, the modernization and rehabilitation and the creation of modern, specialized plants have been established as the basis for executing the urgent plans and social obligations chosen by the sector for the 10th Five-Year Plan.

Among the highly industrialized plants which produce small-scale electrical equipment one could name the Bakinskiy home air conditioning plant; specialized shops for the production of washing machines at the Riga electrical machine construction plant; shops for the production of fans at the Yaroslavskiy electric machine construction plant; and a number of lighting equipment unions--"Svetotekhnika" in Saransk, "Vatra" in Tiraspol and others.

A broad program for the introduction of new production capacities has been worked out.

During the course of the present Five-Year Plan, reconstruction has begun on electric light plants in Saransk, Ufa, Tomsk and Poltava. In L'vov, a large-scale electric light plant is being built, designed to produce 320 million lamps per year. Production at the Eletskiy battery and "Prozhektornye Uzli" plants, at the "Akkumulyator" plant in Kursk and the "Sirius" plant in Klaypedsk is expanding. With the engagement of these and other production capacities, the population's demand for incandescent lamps and galvanic batteries will be satisfied.

The broadest strata of the population employs home appliances. For example, a lathe unit with preset control is operated by a specialist who's gone through the corresponding training, but often a man who hasn't the necessary skill to operate equipment must deal with a washing machine. At the same time, a modern washing machine, such as the "Svrika-Avtomat", is a complicated design in which electrical power equipment interacts with an electronic mechanism. Nevertheless, its operation is easily understood by anyone, since it's started with only the push of a button. On the whole, one of the general trends in the improvement of small-scale electrical equipment is the introduction of automated mechanisms.

The operating conditions for modern home appliances are also highly specific. More and more often they dictate their demands to the engineering and technical facilities of living quarters, the floor plans and the electrical outlets. That same automatic washing machine, for example, must be stationary when connected to drains and water pipes; the use of an air conditioner is provided for with changes in the window openings. One may continue with a number of such examples in which the feasibility and efficiency of utilizing home appliances goes beyond the limits of the producer's competency. We are convinced that the modern scope of the application of technology in the home presents us with the problem of over-all planning for the home of the future. In this work the opinions of architects, builders, electrical engineers and the creators of home appliances should be strictly coordinated and argued out. Only then will it be possible to achieve truly comfortable conditions for a man in his house.

New demands for home appliances are now cropping up with respect to the product's outward appearance. That which is intended for man's everyday life should be beautiful and comfortable. Attaching great significance to the artistic form of of domestic products, we are beginning to develop, along with specialists of the All-Union Scientific Research Institute for Technical Aesthetics, an over-all artistic design program which has as its goal a determination of the principles of artistic design in home appliances and their embodiment in base-line models. We hope that the realization of the program will also permit us to influence to a certain degree the forming of consumer taste.

And, finally, a very important distinguishing feature of small-scale electrical engineering is the difficulty in identifying the true needs of the population for this product or that. One may determine with this or that degree of accuracy the extent of the demand for items such as washing machines, vaccuum cleaners, irons, etc., but it is very difficult to do this with brand-new products. No one today can determine for sure what the demand for dishwashers or clothes dryers will be in the coming years. Such questions are cropping up more and more before the producers of home appliances, and the answers to these greatly determine the rationality of selection policies.

In this manner, summing up all the specific problems in small-scale electrical engineering, we see that, in order for electrical home appliances to be durable, comfortable, reliable and safe in operation and in order for them to be really efficient helpers of man, the efforts of one sector are not enough. The corresponding materials, technical equipment for the rooms and an objective and accurate evaluation of the people's demand for

appliances in the home are needed. In other words, what's required is a coordination of plans and more practice in the development of production of goods for the population.

The resolution of the CPSU Central Committee and the USSR Council of Ministers, "On the Improvement of Plannig and the Strengthening of the Economic Machinery's Influence on the Increase of the Efficiency of Production and the Quality of Work," is also oriented toward an over-all interlinked solution to the technical, economic and social tasks and toward overcoming a narrow, bureaucratic approach to this matter. Only a coordination of efforts, agreements and mutual aid in the actions of various ministeries can help in solving the broad circle of problems that are connected with the creation and assimilation of highly efficient equipment for the home.

Here is one such problem. In recent years there has been a sharp rise in the demand for table and standard lamps. The production of these lamps is increasing rather rapidly but it still hasn't managed to satisfy the population's demand. This is, first of all, due to a shortfall in the production of plastic-film and lighting-engineering materials at enterprises in the chemical, lighting and paper industries. No small contribution to increasing the output of lamps for the home could have been made by local industry. At the enterprises of local industry they can expediently organize the production of parts from ceramics, porcelain, wood and other decorative materials and supply them to the electrical engineering industry by way of cooperatives.

Our cooperation with commerce requires improvement, also. Industry, in fact, is oriented toward satisfying the demands of commerce but, unfortunately, they do not always reflect the true dimensions of the demand. This, incidentally, serves as one of the reasons for interruptions in the lamp trade. As it turned out, a great many lamps intended for the retail market went to satisfy the needs of industry, communal domestic households and transportation. It is thought that the work begun by the USSR Mintorg (Ministry of Trade) along with the industrial ministries on the creation of an over-all system of studying and predicting the demand for domestic-use goods will help to eliminate the miscalculations that have been made. The specialized company stores of Minelektrotekhprom (Ministry of the Electrical Equipment Industry) in various cities in the country should become a great help in the practical study of the demand for home appliances. It seems necessary to master the economic mechanism that closely links the material incentives of the workers in commerce with that of the producers of goods for the home.

Now a few words on component parts. Many industrial ministries which produce complex domestic equipment run up against great difficulties when obtaining products from cooperatives which often determine both the operational reliability and the functional potential of this or that device. There's a certain resistance shown not only by plants in cooperating sectors but also by enterprises within the jurisdiction of the Minelektrotekhprom, since component parts are not counted by it as consumer goods.

It's necessary for the State planning bodies to establish a system under which the organization of the production of component parts for domestic trade would be profitable for the enterprises, which would then be stimulated themselves in a corresponding manner. In our opinion, in some cases the assignment to produce component parts could be basic and even natural for those enterprises. For example, for a plant such as "Kiasselektroapparat" (expansion unknown), which provides the vaccuum motors for practically every manufacturer of vaccuum cleaners in the country, this production could be considered as primary in regard to the output of consumer goods. In similar situations the potential broadens for solving questions of integrating component units and individual parts, obtaining the maximal effect from the organization of specialized production, and lowering the unit cost of the product.

The resolution of the CPSU Central Committee and the USSR Council of Ministers puts at our disposal new controls for improving the entire economic mechanism of the socialist economy and for bettering the efficiency of social production in the name of increased prosperity for Soviet people. It's important to use these potentials sensibly with maximum efficiency.

9512
CSO: 1822

BENEFITS AND PROBLEMS OF DNESTR RIVER GES

Moscow TRUD in Russian 15 Sep 79 p 4

[Commentary by S. Prokopchuk: "Water and Energy"]

[Text] On the Dnestr, construction has begun of a unique complete hydraulic development which differs from other similar designs in that it allows for the immediate solution of four economic tasks.

The beast, you'll have to admit, was somewhat sinister. The grinding of the huge ice floes, as they rose up on their legs and were driven by heavy spring floods, seemed to carry for hundreds of versts. The bluish-grey blocks, resting one upon the other, clambered up on the gently sloping banks. The Dnestr seemed to get mad.

Is it this way often?

Add it up, every five years...

There was worry and alarm written on the face of V.A. Yaremchuk, secretary of the Kamenets-Podol'skiy party raykom: there's trouble ahead if extraordinary measures are not undertaken. Why, it's here, and not only here, that they know the power and the insidiousness of this river's spring floods. The damage that it inflicts is estimated in the millions of rubles. That's the way it was.

And here I am again on the Dnestr. It's autumn. The weather's warm. The Dnestr's now gentle and quiet beyond recognition. From a height, the panorama of the Dnestrovskiy complete hydraulic development is literally spread before your eyes.

The construction project is unique. Its unusualness is concealed in its very name-a complete hydraulic development. In the first place, the electric energy produced at the hydroelectric station will be indispensible for the Ukraine's southern electrosystem

during peak hours. In the second place, the three-billion cubic meter reservoir will supply water to a number of oblasts and will irrigate 470,000 hectares of presently poor soil in the Ukraine and Moldavia. Finally, the hydraulic system will bring to a minimum the damages to hundreds of villages and cities caused by the wayward river. Mogilev-Podol'skiy, by the way, was flooded this spring by waters of the Dnestr. During high water, the flow will be "doled out" by the GES's dam. It will rush through six tunnels to the turbines and also through twelve special apertures in the body of the dam.

However, this isn't the only unique thing about the hydraulic development. Twenty kilometers downstream from the GES, the builders are confronted with building a so-called "little sea"- a buffer reservoir. There one more electric power station will rise-a hydraulic accumulator. At night, on holidays and on off-days, when there's not a requirement for a great amount of electrical energy, the station's turbines, working like pumps, will transfer water from the lower level to the higher level, as if accumulating it for future work. During peak load hours when electrical energy is needed, the water will rush in the usual direction-down with the river's flow, where it will begin to turn the turbines.

But this is in the future. Now, the first unit of the GES's hydraulic development should begin producing current as early as the end of 1980.

Unfortunately, the fulfillment of these tasks is under a threat of work stoppage. The rate of laying concrete is being held up by the deliveries of cement and rolled metal. These materials, so necessary for the construction, are being delivered in quantities smaller than are required. There's a constant arrhythmia both in the living quarters and in social services construction. The project requires more appreciable aid on the part of oblast organizations and the USSR Ministry of Energetics and Electrification.

9512
CSO: 1822

ANTONOV ON 11TH FIVE-YEAR PLAN

Moscow EKONOMICHESKAYA GAZETA in Russian No 38, Sep 79 p 2

[Article by A.K. Antonov, minister of the electrical equipment industry: "The Electrical Equipment Industry"]

[Text] In the review "The Electrical Equipment Industry" (weekly No. 31) an objective economic analysis was given of the work in the sector on the further improvement of the efficiency of production, and the execution of the annual and Five-Year Plans. As was only fair, the shortcomings were noted along with the positive results.

The Board of the Minelectrotekhprom has committed leaders of management and unions to mobilize with scientific research institutes and conduct an over-all inquiry into those enterprises which have systematically not carried out their tasks and to draft a system of measures to undo the "bottlenecks" and to eliminate the causes of interference in stable and efficient work. In connection with the lag in fulfilling the plan for deliveries of electrical equipment for diesel locomotives, and also the breakdown of individual turbogenerators manufactured by the "Eletrotyazhmash" plant in Kharkov, measures for rendering aid to the plant have been reviewed and approved by the board. Control over the execution of these measures has been established

The ministry has analyzed the causes of the inefficient utilization existing in the power sector. The further increase in the work shift coefficient of equipment and the mechanization of industrial processes is being held up by shortfalls in a number of specialized technological processes. A program for the creation of an industrial production base for the manufacture of specialized technological equipment is now being realized for the successful solution to this question. Its output will be earmarked for an independent subsector which will be given the responsibility for the technical refitting of the corresponding processes in all enterprises. An intensive development of the production of such equipment is foreseen. For the 11th Five-Year-Plan, its

production will increase two-fold. This will soon make possible a sharp reduction in the amount of manual labor as well as free labor resources to increase the work shift coefficient of the equipment and accelerate the mastery of new projects.

Additional measures have been adopted for accelerating the mastery of new technology for the production of light bulbs at the L'vov electric light plant, which will make possible an increase in the assembly-line load. At the Lurinets agricultural electric motor plant, additional foundry capacity will be brought about this year. This will guarantee a balance in the technological redistribution in the production of electric motors.

For 1980-1985 full plans for the economy of resources have been developed and approved. They include measures for the creation of products of simplified design, the introduction of low-waste technological processes, a broadening in the application of advanced rolled metal and substitute profiles and the improvement of organization in storage, transport, and standardization of materials. An important position is set aside for measures to step up the output of products with increased work capacity, which will decrease the demand for such types of equipment by consumers in the sector. This will make it possible to substantially raise the utilization coefficient of rolled ferrous and nonferrous metals.

In the review, the shortcomings connected with the delay in setting up an installation for economical cutting of electrotechnical-grade steel at the Yaroslav electrical machine construction plant have been imposed upon the guilty parties. At the present time, a network schedule has been drawn up and approved for commissioning the installation in October of 1979.

While drafting the plan for 1980, the remarks made in the review were taken into consideration and the necessary resolutions were adopted, which permit increasing the level of economic activity and accelerating the introduction and assimilation of new capacities. The realization of measures that demand a greater period of time for execution will be put into the draft of the plan for 1981-85.

2517
CSO: 1882

CEMA COOPERATION IN THE FIELD OF ENERGY

Kiev PRAVDA UKRAINY 15 Aug 79 p 3

[Article by V. Begishev, political observer for the APN: "Energy Resources of Member-Nations of the CEMA"]

[Text] The well-known tension in the fuel-energy balance that has arisen in recent years in a number of European member-nations of the CEMA is no secret, but this doesn't provide any reason for discussing the development of some sort of "crisis" situation. There's no doubt that energy is becoming more expensive, and to a significant degree this has brought about recent measures adopted by the majority of countries in the region to regulate retail prices. However, there is every reason to suppose that it is a question of steps that are temporary in nature, and that in the not too distant future the problem will be solved and solved fundamentally.

We note, first of all, that lately in the West (especially in the reports of the CIA, then later picked up by mass media) there is a propagandistic version of how the energy resources of the socialist world are being depleted. This is disproved by the facts. Not only is the output of energy-producing raw materials growing (for example, the output of oil and refined products rose by three percent in our country for the first six months of this year, and natural gas output rose by nine percent more than it did for the same period last year) but the geological base of the fuel-extractive industry is constantly expanding. In the same way, 147 oil and gas deposits were discovered in the European member-nations of the CEMA in only 1966-1975. These are not large-scale deposits but as a whole they create an appreciable reserve. In the Soviet Union in only the last year, 44 such deposits were discovered. This came about even though some of the prospective territories and wetlands (Western Siberia, for example, or the northern and eastern continental shelves) have as yet been little studied. Geologists also have (to their credit) accounted for such relatively recent "gifts" as the coal basins

of Lyublin (40 billion tons) in Poland; Slani in Czechoslovakia; Tataban'i in Hungary and many others. However, of course one can't count on this "piggy bank" being eternally refilled. In addition, the extraction of traditional energy resources is getting more and more expensive. How is the problem to be solved?

The first solution lies in the broad development of atomic energy. In combination with a number of other scientifically founded trends, it comprises the essence of a long-term special program of collaboration among member-nations of the CEMA in the area of energy, fuels and raw materials. The plan was approved at last year's 32nd session of the CEMA.

The drafting of this plan was brought about by two basic factors: the necessity for ensuring in the future a reliable energy base for the developing socialist economic structure and by the desire to overcome the negative consequences of the unfavorable situation taking shape on the world fuels and raw materials market. The latter is particularly important for those European members of the CEMA that have their own limited reserves of fuel and raw materials.

The program envisions the construction of atomic electric power stations of approximately 37 million kilowatts total output in the member nations of the CMEA and also in Cuba. Two more such stations will also be built in the USSR especially for the delivery of energy to its brother nations.

The fufilment of this segment of the program will be ensured through large-scale multifaceted cooperation in the production of the equipment. A corresponding agreement which, in the final analysis, would make possible the increase by more than a third of the electrical energy potential of the CEMA member-nations and Cuba was signed in Moscow at the end of June.

Another important direction of the program is the increase in extraction and the improved utilization of solid fuels. There is a huge reserve for the socialist countries of Europe, and they are making more and more of an effort to utilize it fully. Thus, at the last session of the CEMA Willy Stof, head of the GDR's delegation and chairman of the GDR Council of Ministers, reported on the intention of the GDR to apportion appreciable funds for an even broader utilization of brown coal. The economical expenditure of fuel should aid measures directed at raising the efficiency of equipment at the more wide-spread thermal electric stations and, in particular, raising the output of the power units. In the USSR, for example, units of 800-1,200 kilowatts each will be installed.

At the same time it's assumed that the application of oil as a fuel will be limited. Oil and gas must be subjected to even more intensive refining. This is done partly in the interests of satisfying more completely the demands of the nations of the socialist cooperative for engine fuels.

The program also provides a new impetus for the further development of unified electroenergy systems of our brother States. In the future this will allow the creation of the most powerful internation power amalgamation in the world, extending from the shores of the Pacific to the center of Europe.

The realization of the plans we've outlined will signify a giant stride forward in the matter of creating a material base for socialism and communism. Now and in the future the socialist countries can build the new society, fearing not the "energy famine".

9512
CSO: 1822

ELECTRIC POWER AND POWER EQUIPMENT

BRIEFS

TUVINSKAYA ASSR ELECTRIFICATION--The electrification of the large villages of Tuvinskaya ASSR has been completed. Now village energy production has arrived at the next stage of the work--the electrification of field camps, cattle-breeding farms and shepherds' outposts. Electrical power engineers of the "Sel'electrostroy", the Tuvinskoe construction and installation administration, are conducting work in all regions of the autonomous republic. This year they've installed dozens of transformer substations and laid more than 200 km of electrical transmission lines. [Text] [Moscow PRAVDA in Russian 30 Aug 79 p 2] 9512

TRANSMISSION-LINE TOWER CONSTRUCTION--The very arduous 640-kilometer route of the Kolymskaya LEP (electrical transmission line) is: the Arkagalinskaya GRES (State regional electric power station)-Yagodnoe-Sinegor'e-Orotukan-Strelka-Omsukchan... Even the heaviest prime movers can't go everywhere through the mountain ridges and swamps. In socialist competition on the line the teams of transmission-line tower assemblers is led by V. Ponomarenko; the fitters by A. Zaritovskoye; and the linemen by A. Dudenko. Two sections of the LEP totaling 150 km remain to be built by the end of the year. [Text] [Moscow STROITEL'NAYA GAZETA in Russian 8 Jul 79 p 2] 9512

NIZHNEKAMSKAYA GES--The first of the Nizhnekamskaya GES's power units has been put into operation. Preparations are under way for the installation of a second hydroturbine which the builders are committed to put into operation by the end of this year. The Nizhnekamskaya GES, with a power of more than 1.20 billion kilowatts, will be the third and largest station on the Volga tributary. [Text] [Moscow STROITEL'NAYA GAZETA in Russian 8 Jul 79 p 2] 9512

POWER LINES IN DAGESTAN--The first reinforced concrete transmission-line towers have risen along the shore of the Caspian Sea in the Derbent-Khachmas sector. The more than 100-kilometer-long electric power bridge connects the Northern Caucasas and

Transcaucasas systems. As early as next year the power of the Chirkeyskaya GES will flow along the new LEP-330. Now the energy of this large-scale hydroelectric plant in the Northern Caucasas (its power--one million kilowatts) is transmitted to Kizilyurt, Groznyy, Makhachkala and Derbent along four electric lines. The additional flow of electric energy was accelerated by the growth of new settlements and industrial and agricultural complexes. Besides this, the hydrotechnical structures of the GES have become reliable regulators of the flow of the raging rivers. This has permitted increasing the area under irrigation and has led to crop rotation on massive new tracts of land. [Text] [Moscow TRUD in Russian 5 Sep 79 p 1] 9512

SURGUTSKAYA GRES—At the Surgutskaya GRES the tenth power unit, with an output of 210,000 kilowatts, has been put into industrial service. The power output of the station has reached 2.12 billion kilowatts. The Surgutskaya GRES is the power-producing heart of the entire Priob'ye oil region. It provides electrical power to the oil fields, refining plants, buildings and the oil workers', builders' and geologists' cities. This GRES is the only one in the country operating on incidental natural gas. Putting it into operation has made it possibe to employ a significant portion of the fuel which had not been utilized previously. Builders of the station will put one more unit of the Surgutskaya GRES into operation during the fourth quarter. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 23 Aug 79 p 1] 9512

MARYYSKAYA GRES -- The installation of the 210,000-kilowatt turbogenerator of the fifth power unit at the Maryyskaya USSR 50th Anniversary GRES was accomplished a month ahead of schedule. With the commissioning of this unit the output of the most powerful electric power station in Turkmeniya will reach 1.05 million kilowatts at the end of the year. [Text] [Moscow MOSKOVSKAYA PRAVDA in Russian 29 Aug 79 p 1] 9512

INSTALLATION OF ROVENSKAYA REACTOR--The reactor casing for the Rovenskaya atomic power plant has arrived on the construction platform. The collective at the reknowned Zhdanov plant in Izhorskiy worked for more than a year on its manufacture. Specialists from that enterprise, headed by chief engineer A. Korenskiy have begun lowering the casing into a concrete pit. In a little while the heart of this atomic plant, the reactor, will begin beating within the casing. [Text] [Kiev RABOCHAYA GAZETA in Russian 1 Aug 79 p 2] 9512

CSO: 1822

GAS REGIONS, PRODUCING AND PREDICTED, RATED BY NETWORK SCHEDULING

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR. SERIYA OBSHCHESTVENNYKH NAUK in Russian No 6, May 79 pp 36-40

[Article by Yu. I. Maksimov, Institute of Economics and Organization of Industrial Production, Siberian Division, USSR Academy of Sciences: "Modeling the Development of the Fuel-Energy Complex"]

[Text] Problems of modeling geological exploration are examined in this article as part of inter-industry complexes (on the example of the industry system that embraces geological exploration, the gas industry and the oil and gas construction industry).

About 50 percent of gas consumption in the USSR is in the regions of the Urals and the European part of the country and upwards of 80 percent of predicted reserves of natural gas are in Siberia. And the prime reserves of commercial-category gas are concentrated in a small number of unique deposits in the northern rayons of Tyumenskaya Oblast. Meanwhile in the Tenth Five-Year Plan the gas-yielding regions formerly supplying most gains in gas recovery now are among the regions with stabilizing or even declining recovery. Shifting of the industry to unpopulated regions with challenging natural-climatic conditions meant a worsening of the main technical and economic indicators of gas recovery and trunk pipeline transport.

Natural gas is among the mineral resources hardest to trap, so costs in geological exploration make up a good part of total outlays for exploration, recovery, preparation and pipeline transport of natural gas. Current outlays for geological exploration roughly equal the capital investments for building up the corresponding gas recovery regions and over the long run will exceed them by 1.5-2 times. For sake of comparison we note that the costs in geological exploration for iron-ore and coal deposits are only 4-7 percent of the costs for constructing the corresponding mining enterprises[1]. Searching and exploring for oil and natural gas deposits takes up more than half of all allocations for geological exploration.

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[1] Yu. A. Dzkolovskiy, "Ekonomicheskiye problemy geologorazvedochnykh rabot" [Economic Problems in Geological Exploration], Novosibirsk, Izdatel'stvo "Nauka," 1974, 114 pages

Geological exploration is set aside in a separate sector of the national economy. But its effectiveness must be evaluated from the standpoint of realizing national-economic end goals. Optimizing the country's fuel-energy complex makes it possible to evaluate the rational proportion of natural gas in the country's fuel-energy balance. Let us look at a two-level system of models for optimizing the long-term plans for the development of an inter-industry program complex, in which the network optimization models are used at different hierarchical levels: a) the lower level, where gas-yielding regions (including geological exploration) are examined as the planning objects and systems of trunk gas pipelines and enterprises in the oil and gas construction industry and b) the upper level, where the planning object is the system that embraces the Unified Gas Supply System [YeGS] of the Country, geological prospecting and the oil and gas construction industry.

Let us look at the network optimization model of the upper level. As the goal function we take the condition of minimizing the total prorated costs for constructing and reconstructing the objects of the YeGS, gas recovery and pipeline transport and the carrying out of geological exploration. In the network model of the upper level, the optimization variables will be the gas recovery volumes and the increment in gas reserves in the gas-yielding regions, as well as the values of the inter-regional gas flows through the functioning and the in-planning systems of gas trunk pipelines. It must be noted that the lack of gas reserve increments for any of the gas-yielding regions will evidence (within the framework of the problem posed) that carrying out geological prospecting in this region from the standpoint of getting the end product is not effective. However, in local estimates the actual costs in geological exploration in this region can also prove to be at a minimum.

Effective use of network optimization models in long-term planning is based on two fundamental and fairly recently elaborated principles--working out of multilevel systems of models and optimizing the development of industrial systems. As a model of the upper level, we can select in the multilevel system of models the resource network schedule, whose studies will be characterized by parameters in four categories: estimate of the duration for carrying them out and of the required resources corresponding to their realistic estimates, as well as volumes of product output[2].

Their consideration in a directed graph Π on whose structure no special constraints are imposed. This form can be adopted in describing the system of parameters characterizing the operation $(\alpha,\beta)\in\Pi$. The parameters of some operations (α,β) can be specified by the matrices $M_{\alpha,\beta}$, which describe the discrete dependences of the prorated costs and the demand for resources for carrying out the operations (α,β).

[2] "Planirovaniye otrasli-vykh sistem (modeli i metody optimizatsii)" [Planning of Industrial Systems (Optimization Models and Methods)], edited by A. G. Aganbegyan, L. A. Kozlov and E. M. Kazakevich, Moscow, Izdatel'stvo "Ekonomika," 1974, 320 pages.

Let there be n operating and in-planning gas-yielding regions. We will call a gas-yielding region an operating region if a certain level of gas recovery will have been already attained in it by the beginning of the period in question. We will define as an in-planning gas-yielding region one where the gas recovery is virtually absent by the beginning of the period in question, but the region can begin operating during this period of time[3].

It must be noted that under the proposed approach to optimizing the development of the industrial system including the gas industry, geological exploration and the oil and gas construction industry, no regions are singled out for geological prospecting. This work can be carried out either in the operating or the in-planning gas-yielding regions. And for each of them to be able to begin operating during the period of time in question, the strategy of conducting geological prospecting in the period must be spelled out so that most of the capital investments are allocated for the increment in category C_1 reserves (with assurance of the minimum attainable proportion of the increment in category B reserves). Under this approach to modeling the industrial system we are looking at there is the possibility of estimating the effectiveness of the increment in gas reserves in each region of the country in terms of the end product, that is, from the standpoint of getting the maximum national-economic benefit from natural gas use.

The subset of operating gas-yielding regions n_1 ($n_1 \leq n$) is connected to the centers of gas consumption by the functioning system of gas trunk pipelines. Let these systems of gas pipelines, as to configuration, be specified by the augmented matrix of incidence $A = ||a_{ij}||$. During the planned period of time there may be reconstruction of the functioning network of gas trunk pipelines, without changing the matrix of incidence A. In addition, when the resource network schedule is used, we must specify as the optimization model of the upper level also the augmented matrix of incidence $\bar{A} = ||\bar{a}_{ij}||$, corresponding to the possible development of the system of gas trunk pipelines. This network can either link up the in-planning gas-yielding regions with some gas consumption centers or form new gas flows from individual gas-yielding regions.

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[3] Yu. I. Makhnovs, "Network models in long-term planning of the development of the gas industry," EKONOMIKA GAZOVOY PROMYSHLENNOSTI, No 11, 1975, pp 3-10; ibid, "Network models in long-term planning of the development and the siting of gas industry objects," in the book: "Optimizatsiya planov razvitiya i razmeshcheniya obrabatyuvayushchikh otrasley promyshlennosti" [Optimization of Plans for the Development and Siting of Processing Industries], Novosibirsk, Institute of Economics and Organization of Industrial Production, Siberian Division, USSR Academy of Sciences, 1977, pp 3-16.

To find the characteristics of the network schedule operations, we assume that we know the prorated costs as functions of the gas volumes in all the operating gas-yielding regions, the costs for geological exploration (the dependence of costs on the increment in reserves), the operating costs as a function of the productivity for each augmented section of the functioning system of gas trunk pipelines and the prorated costs as functions of the gas flows for the augmented sections of the in-planning network of gas trunk pipelines.

The value of $Q_k^{\alpha,\beta}$ as a function of the origin of the operations (α,β) in a particular augmented object of the YeGS will stand for the volume of gas recovery in any gas-yielding region, the productivity of the augmented section of the functioning or projected system of gas trunk pipelines and the increment in gas reserves by individual gas-yielding region.

Let us note the main constraints taken into account in the network model of the upper level: a) on the minimum attainable annual gathering of gas from the gas-yielding regions that are operating; b) on the total gas recovery country-wide (by years of the planning period); and c) the recurrent balance ratios on the recovery volumes and the increment in gas reserves.

In addition, in accordance with the augmented matrix of incidence of the functioning system of gas trunk pipelines A and the augmented matrix of incidence of the in-planning network of gas pipelines $\tilde{A}$, balance constraints of the equality of gas flows in each of the branch points and the endpoints of the functioning or in-planning augmented systems of gas trunk pipelines must be imposed on the variables $Q_{s*}^{\alpha,\beta}$ being optimized.

The complex of constraints on the resources can be described as follows:

$$\sum_{(\alpha,\beta)} r_k^{(\alpha,\beta)} \quad \vec{D}(t) \le \vec{R}(t), \quad 0 \le t \le T \tag{1}$$

where $\vec{D}(t)$ is the vector-diagram of the distribution of resources obtained by optimizing the network model of the upper level; and $\vec{R}(t)$ is the constraints on the resources specified from the allied industries.

And resources are understood, in the broad sense of the word, to refer to both material and equipment, as well as labor resources. So constraints on the shipments of pipe and gas pumping installations as well as on the capacity of enterprises and the construction base of the oil and gas construction industry can be allowed for in the complex of constraints (1).

Let us note the need to allow for the following ratio:

$$\frac{\sum_{i=1}^{n} Q_{i,0}}{q_{\Sigma,1}} \approx \frac{\sum_{i=1}^{n} Q_{iT}}{q_{\Sigma,T}} \tag{2}$$

The value of parameter ξ in Eq (2) must be specified on the basis of calculations made at the national-economic level. As Eq (2) tells us, the ratio of the total volumes of geological exploration and the total volumes of gas recovery is regulated by ξ. When $\xi = 1$, the multiplicity factor of the gas reserves at the end of the planning period is retained just as it was at the beginning of this period. If $\xi < 1$, the rate of increment in reserves must outpace the recovery rate. The quantity $\xi > 1$ denotes the decrease in the multiplicity factor of the gas reserves by the end of this planning period under consideration.

Agreement between the different stages of development or reconstruction of gas-yielding regions and the corresponding systems of gas trunk pipelines is brought about by introducing the necessary connections when constructed directed graph Ω. Papers by Maksimov[4] describe one of the possible iterative procedures of interchanging information between the upper and lower levels; as a result of this procedure agreement is obtained for the solutions to these levels. Information about the functions of costs for different YeGS objects and for geological exploration comes to the upper level. But in the models of the lower level is transmitted information about the distribution of the constrained resources by YeGS objects and geological exploration, as well as information about the successive approximation of their optimal productivities.

We must note that applying the network approaches in multilevel systems of models of optimal long-term planning of the development of industrial systems allows us to investigate the correlations and properties of the development of these systems whose study would be extremely difficult--with the aid of other optimization models--or theoretically impossible. Among the advantages of the network models we must include: a) the possibility of relatively simple optimization of the long-term plan on a dynamic basis, which is predetermined by the essentials of network models; b) establishment of the necessary interconnections in time between different stages of the installation or reconstruction of any object, as well as between technologically coordinated stages of installing individual objects; c) additional possibilities of allowing for the connections of the industrial system in question with allied industries of the national economy by using the systems of deliveries; and d) the virtual absence of rigorous requirements on the kind of functions for the complex of constraints and the end function assumed (for example, linearity, convexity and so on).

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[4] Yu. I. Maksimov, "Network models in long-term planning of the development and siting of gas industry objects"; ibid, "Agreement of network models of long-term planning of the development of the industry and enterprise (on the example of the Unified Gas Supply System of the Country)," in the book: "Modelirovaniye vnutrennykh i vneshnikh svyazey otraslevykh sistem" [Modeling Internal and External Connections of Industrial Systems], Novosibirsk, Izdatel'stvo "Nauka," 1978, pp 219-228.

The approach described in this article was used in making multivariant calculations in predicting the development of the gas industry for the period to the year 2000. An examination was made of variants of gas industry development characterized by maximum acceleration and intensification of technical progress both in the designing, construction and operation of extra-capacity systems of trunk pipeline gas transport (especially for specific Siberian conditions), as well as in the development of unique gas deposits: transport of supercooled gas through large-diameter pipelines, use of gas pumping installations with increased per-unit capacity and reliability and so on.

These calculations show that the optimal productivity of a 1420 mm diameter gas trunk pipeline, at maximum allowable working pressure of 120 atm is 45-50 billion m^3/year. But if the temperature of the gas transported is cooled to -65° to -75° C, the productivity of this gas pipeline rises to 68-74 billion m^3/year. As calculations show, metal consumption can be lowered here by 28-35 percent. Gas pumping installations with a per-unit capacity of 25,000 and 50,000 kW would be optimal for the planned flows of Tyumenskaya gas. Use of gas pumping installations with increased per-unit capacity would permit lowering the capacity of the installed stock of gas pumping installations by 30-40 percent in the 11th and 12th five-year plans.

An analysis of the experience in designing, installing and operating gas industry objects shows, there are good reserves in the industry. We must mention that special attention was given to analyzing sources of reserves that help in reducing capital investments in the industry and in lowering material consumption and the capital-to-output ratio without displacing heavy additional requirements on the allied industries in the national economy (for example, installing line sections of gas trunk pipelines that are telescoping by pressure, shortening the schedules for bringing gas trunk pipelines up to design rating and so on).

Detailed calculations were made in predicting gas recovery from the deposits of the Western Siberian oil and gas-bearing province.

The beginning of the industrial exploitation of natural gas deposits in the Western Siberian oil and gas-bearing province can be conditionally regarded as 1965, but gas recovery in this year was slight. In 1970 it was 4.7 percent of the union-wide recovery, and in 1975 it climbed to 11.5 percent of the union-wide recovery. Siberian gas recovery in 1980 is planned at the level of 32-37 percent of the union-wide recovery.

Over the long run, Siberian gas (even given the condition that the variant is assumed in which the gas is relatively slowly brought into national-economic turnover) will satisfy a considerable fraction of both the union-wide gas demand, and export deliveries of natural gas. So the industrial problems of the development and siting of the gas industry will become, each year, increasingly Siberian problems.
[533-10123]

ADVANCED EXTRACTION EQUIPMENT LACKING AT UZEN' OILFIELD

Moscow PRAVDA in Russian 18 Sep 79 p 2

[Article by V. Timonin, General Director of Mangyshlakneft' Production Association, Shevchenko: "Difficult Oil"]

[Text] Oil from Mangyshlak proceeds through pipelines to the central regions of the country in a continuous flow from the hot deserts. Currently new fields on the Buzachi Peninsula are becoming operational. Their development is indicative of the development of the Mangyshlak territorial production conplex. At the same time, we oilfield operators are inclined to speak more of unsolved problems than of our successes. And there are a number of difficulties on both old and new oilfields.

Mangyshlak oil contains high percentages of paraffin, tar and asphalt components. Accordingly it hardens at a temperature of +32 degrees. This property leads to complexities in its extraction, collection and transport. Accordingly, the oil workers are faced with a good number of problems. Let me discuss a few of them.

The development of the Uzen' field was planned by the All-Union Scientific Research Institute of Oil and Gas. To increase output, it was planned to pump hot water into the reservoirs. This was logical. But the planners did not say where 150,000 cubic meters of fresh water a year would be obtained and how it would be heated. For we live and work in the desert, where there is not enough water for either industrial or domestic needs. The Caspian Sea and underground mineral waters are a realistic source. But we have been able to heat such a quantity of sea and mineral water and have had no commercial facility to do so. The specialists of the Mangyshlakneft' association, together with various planning and research institutes, have been trying to solve this problem for a number of years--and without any particular success, it must be said. Various types of heating installations have been developed and tested, but the pilot commercial stage has never been reached. There are now six types of installations in operation on the Uzen' field, but not one of them has been put into series production, since all of them suffer from inadequacies.

The Uzen' field has natural hot waters: there is no need to heat them, and they can be taken and pumped into the formations. And we are doing so, but we are

pumping a total of only two or three thousand cubic meters. The extensive utilization of these waters is being delayed by the chronic shortage of underground pumping units capable of working at high temperatures. Thus we have nothing to heat cold water with and nothing to pump hot water with. For this reason, two-thirds of the mineral water is fed into the reservoir without heating. As a result, we risk failing to reach the planned yields for the reservoirs.

And this is not all. Several years after the beginning of operation of the oilfield, when the mineral water that had been pumped into the reservoirs appeared in the wells, there arose new difficulties: the precipitation of undissolved salts. They precipitate in the bottom-hole region of the wells, in the spaces in the underground equipment, and on the inner surfaces of oilfield piping. There are frequent stoppages for repair, preventive maintenance and replacement of out-of-order equipment, leading to considerable losses of time and resources, and these of course decrease the yield of oil.

In addition to salt formation, hydrogen sulfide contamination of the reservoirs has begun. The hydrogen sulfide has appeared in the casing-head gas. This has made its utilization more difficult, since the gas refinery that has been built is incapable of sulfur purification. Now we have had to build a facility in a hurry.

There might be no point in dwelling is such detail on the problems of Uzen' if they were by nature confined only to Mangyshlak. The problem is that salt deposition and hydrogen sulfide contamination are typical of many of the country's fields: the problems also afflict the oil workers of Perm', Orenburg and West Siberia. They show up in different ways, but they inevitably bring losses.

When the general outline and the development plans for the oilfields are being drawn up, our sectorial institutes do not take into account the chemistry of the reservoir and the pumped-in waters, and do not try to forecast the processes which might develop subsequently. And academic science is remote from this problem. I do not wish to accuse the researchers and planners of shortsightedness. Rather, they are simply striving to make their plans less expensive. They do achieve economies, but during operation of the oilfields the state loses much more than it saves. A certain share of the blame also lies with the sectorial staff: the Ministry of the Petroleum Industry. It is no secret that in order to speed up oil extraction, scientific studies and detailed preparation of accompanying industries are frequently ignored.

Let us turn to the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on the Improvement of Production Efficiency and Work Quality." This document discusses the necessity of developing programs for solution of the most important scientific and technical problems and making comprehensive use of natural resources. The results of fundamental and applied research are to be

taken into account, and the ultimate aims, the technical and economic results, the schedules and the stages of performance of the work are to be defined. But the importance of the oil industry is now so great that our sectorial problems must also be solved in the framework of such a program.

We are now preparing to develop that new oilfields of Kalamkas and Karazhanbas on the Buzachi Peninsula. But the same story has been repeated there: there is oil, there is the desire to extract it, but an optimal process for extraction and the corresponding equipment are lacking.

The oil from the Karazhanbas field contains much tar and is highly viscous. With existing methods, not more than 10-15 percent of it can be extracted. In order to increase the yield, thermal treatment of the reservoir will be necessary. Neither this country nor foreign countries have any experience in the extensive use of thermal methods. Karazhanbas is the first large oilfield where their use is planned from the very beginning. To study thermohydrodynamic processes and improve the method, pilot commercial work is planned for two experimental fields. On one of them, the method of in-situ moist combustion will be tested. But this advanced method is slow in reaching commercial scale: the equipment and control and measuring apparatus are lacking. It is true that the Ministry of Chemical and Petroleum Machine Building has begun to produce special units, but they are of low capacity and can only fit out two or three injection wells.

Things are no better with the development and production of equipment for steam treatment of reservoirs. The main difficulty is that Mangyshlakskaya Oblast lacks sources of fresh water for the steam generators. Desalination installations are required, but no one has begun to produce them.

Let me mention one progressive direction in the oil extraction industry: the use of chemical reagents. For example, to increase the output of reservoirs on the Kalamkas field, water thickened with polymers will be used. This will make it possible to raise the viscosity of the water close to that of the oil under reservoir conditions, which will significantly increase yields.

I should like to stress that this is not the first time that the above-mentioned problems have been discussed. Three years ago, four ministries, those of Chemical Machinery, Power Machinery, Instrument Making, and the Chemical Industry, were assigned the development and delivery to the oil workers of equipment and apparatus for thermal treatment of reservoirs. The Ministry of the Chemical Industry and the Ministry of the Petroleum Industry were to increase their production of the necessary reagents. Since then there have been no important changes. But it should be kept in mind that the supplies of oil are not unlimited, and the way in which the national economy is supplied with oil in the future will depend on how today's problems are solved.

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